

West Bengal State University



Draft UG syllabus for **Zoology as Major**

| Semester | Course structure | Name of paper | Credits | SEC |
|---------------|------------------|--|---------|----------|
| Semester I | DS-1 (5) | Non-Chordates I Non-Chordates I Lab | 3 2 | SE- 1(3) |
| Semester II | DS-2 (5) | Non-Chordates II Non-Chordates II Lab | 3 2 | SE -2(3) |
| Semester III | DS-3 (5) | Chordates Chordates Lab | 3 2 | SE-3(3) |
| Semester IV | DS-4 (5) | Comparative Anatomy and Physiology Comparative Anatomy and Physiology Lab | 3 2 | |
| | DS-5 (5) | Ecology Ecology Lab/Field | 3 2 | |
| | DS-6 (5) | Cell Biology Cell Biology Lab | 3 2 | |
| | DS-7 (5) | Biochemistry Biochemistry Lab | 3 2 | |
| Semester V | DS-8 (5) | Molecular Biology Molecular Biology Lab | 3 2 | |
| | DS-9 (5) | Genetics Genetics Lab | 3 2 | |
| | DS-10 (5) | Animal Behaviour and Chronobiology Animal Behaviour and Chronobiology Lab | 3 2 | |
| | DS-11 (5) | Endocrinology, Histology and Histochemistry Endocrinology, Histology and Histochemistry Lab | 3 2 | |
| Semester VI | DS-12 (5) | Biostatistics and Taxonomy Biostatistics and Taxonomy Lab | 3 2 | |
| | DS-13 (5) | Developmental Biology Developmental Biology Lab | 3 2 | |
| | DS-14 (5) | Evolutionary Biology Evolutionary Biology Lab | 3 2 | |
| | DS-15 (5) | Immunology Immunology Lab | 3 2 | |
| Semester VII | DS-16 (5) | Entomology and vector biology Entomology and vector biology Lab | 3 2 | |
| | DS-17 (5) | Biodiversity and Conservation Biodiversity and Conservation Field | 3 2 | |
| Semester VIII | DS-18(5) | Research Methodology and Scientific writing Research Methodology and Scientific writing Lab | 3 2 | |
| | DS-19(5) | Toxicology & Cancer Biology Toxicology & Cancer Biology Lab | 3 2 | |
| | DS-20(5) | Fisheries sciences Fisheries sciences Lab/Field | 3 2 | |
| | DS-21(5) | Parasitology Parasitology Lab | 3 2 | |

Semester I

DS-1: Non-Chordates I (Theory, 3 credits = 45 classes):

Course Objectives:

Invertebrate animals have been used medicinally for 4,000 years and have served as models for research and teaching since the late 1800s. This course contents will introduce the students to the systematic and scientific studies of the various forms of invertebrate animals present on Earth. They will learn about the general characteristics of invertebrates. The course will discuss the classification, structural and functional aspects of invertebrates. Students can identify the relative importance of invertebrates in evolutionary processes. In the laboratory work, students will understand the morphological and anatomical features of invertebrate animals.

Unit 1: General introduction to Protista and Metazoa

15 classes

General characteristics and Classification of Protozoa up to phylum (Levine, 1980)
General characteristics *Amoeba*, *Paramoecium* and *Euglena*
Life cycle and pathogenicity of *Entamoeba histolytica*, *Plasmodium vivax*, *Giardia intestinalis* and *Leishmania donovani*
Locomotion and Reproduction in Protista (*Amoeba*, *Paramoecium* and *Euglena*)
Evolution of symmetry and segmentation of Metazoa

Unit 2: Porifera

6 classes

General organization and Classification up to classes Canal system and spicules in sponges

Unit 3: Cnidaria

5 classes

General organization and Classification up to classes Metagenesis in *Obelia*
Polymorphism in Cnidaria
Corals and coral reefs: types, formation, distribution, conservation significance

Unit 4: Ctenophora

3 classes

General organization and evolutionary significance

Unit 5: Platyhelminthes

6 classes

General organization and Classification up to classes
Life cycle and pathogenicity of *Fasciola hepatica* and *Taenia solium*

Unit 6: Nematoda

10 classes

General organization and Classification up to classes
Life cycle, and pathogenicity of *Ascaris lumbricoides* and *Wuchereria bancrofti*
Parasitic adaptations in helminths
Origin and evolution of parasitic helminths

Classification to be followed as per Barnes (1994)

Non-Chordates I Lab (Practicals, 2 credits = 30 classes):

1. Study of whole mount of *Amoeba*, *Paramoecium* and *Euglena* , Binary fission and Conjugation in *Paramoecium*
2. Examination of pond water collected from different places for protistan diversity.

3. Study of *Sycon* (T.S. and L.S.), *Hyalonema*, *Euplectella*, *Spongilla*
4. Study of *Obelia*, *Physalia*, *Millepora*, *Aurelia*, *Tubipora*, *Corallium*, *Alcyonium*, *Gorgonia*, *Metridium*, *Pennatulula*, *Fungia*, *Meandrina*, *Madrepora*
5. One specimen/slide of any Ctenophore
6. Study of adult *Fasciola hepatica*, *Taenia solium*
7. Study of adult male and female *Ascaris lumbricoides*

Note:

1. Only conspicuous characters required to identify the organism to be noted along with the known systematic positions of it (for Protozoans up to Phylum and others up to Class)
2. It is wise to study the coloured photographs of the organisms suggested for the study as available from internet sources along with the preserved specimens, if are there, or otherwise.

Text Books:

1. Biology of the Invertebrates by Jan A Pechenik
2. Invertebrates by Brusca and Brusca 2nd Ed
3. References:
4. An introduction to Invertebrates by Janet Moore 2nd ed.
5. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
6. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson
7. Bose, Mala. Parasitoses and Zoonoses, New Central Book Agency , 2017.
8. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
9. Invertebrate Zoology : Third Edition; Paul A Meglitsch , Frederick R Schram January 2020 , OXFORD UNIVERSITY PRESS

Students are encouraged to explore authentic websites (for e.g. Wikipedia, different university websites, OCWs) on internet for reading/audio-visual materials on a particular topic if they do not find enough in the text books.

Course Outcome:

Students would appreciate the diversity of lower and higher invertebrates including arthropods, molluscs and echinoderms with a thorough understanding of the invertebrate animal architecture and functions during evolution. The major outcome is that the course would create awareness of the economic importance and significance of invertebrates. Students will be aware of the involvement of different invertebrate animals in human health and agriculture; diseases caused by invertebrates and the understanding of their modes of transmission by invertebrate animals.

Semester II

DS-2: Non-Chordates II (Theory, 3 credits = 45 classes):

Course Objectives:

Invertebrate animals have been used medicinally for 4,000 years and have served as models for research and teaching since the late 1800s. This course contents will introduce the students to the systematic and scientific studies of the various forms of invertebrate animals present on Earth. They will learn about the general characteristics of invertebrates. The course will discuss the classification, structural and functional aspects of invertebrates. Students can identify the relative importance of invertebrates in evolutionary processes. In the laboratory work, students will understand the morphological and anatomical features of invertebrate animals.

Unit 1: Introduction to Coelomates 3 classes

Evolution of coelom and metamerism

Unit 2: Annelida 4 classes

General organization and classification up to classes Excretion and osmoregulation in Annelida

Unit 3: Arthropoda 10 classes

General characteristics and classification up to classes Respiration in Arthropoda

General organization and evolutionary significance: King Crab and Crustacean Larvae

Unit 4: Onychophora 2 classes

General organization and evolutionary significance

Unit 5: Mollusca 10 classes

General characteristics and classification up to classes Nervous System and respiration in Mollusca

Torsion and detorsion in Gastropoda

Evolutionary significance of trochophore larva

Unit 6: Echinodermata 8 classes

General characteristics and Classification up to classes

Water-vascular system in Asteroidea

Larval forms in Echinodermata

Unit 7: Hemichordata 8 classes

General organization of phylum Hemichordata.

Phylogenetic relationship with non-chordates and chordates (only recent concepts) *.

Filter feeding in *Balanoglossus*

Classification to be followed as per Barnes (1994)

Non-Chordates II Lab (Practicals, 2 credits = 30 classes):

1. Study of following specimens:

Annelids - *Aphrodita*, *Nereis*, *Heteronereis*, *Sabella*, *Serpula*, *Chaetopterus*, *Pheretima*, *Hirudinaria*

Arthropods - *Limulus*, *Palamnaeus*, *Palaemon*, *Daphnia*, *Balanus*, *Sacculina*, *Cancer*, *Eupagurus*,

Scolopendra, Julus, Bombyx, Periplaneta, termites and honey bees

Onychophora - *Peripatus*

Molluscs - *Chiton, Dentalium, Pila, Doris, Helix, Unio, Ostrea, Pinctada, Sepia, Octopus, Nautilus*

Echinoderms - *Pentaceros/Asterias, Ophiura, Clypeaster, Echinus, Cucumaria and Antedon*

Hemichordates- *Saccoglossus*

2. Mount of mouth parts and dissection of digestive system, nervous system and reproductive system of *Periplaneta*

3. To submit a Project Report on any related topic on pond water invertebrate diversity Or life cycles of mosquitoes Or butterfly/moth etc Or coral and coral reefs.

Note:

1. Only conspicuous characters required to identify the organism to be noted. Along with it, the systematic positions of the organism are to be mentioned (up to Class).
2. It is wise to study the coloured photographs of the whole organisms or its parts suggested for the study as available from internet sources along with the preserved specimens, if are there, and otherwise. Dissections of animals other than common pests are discouraged.

Text Books:

1. Biology of the Invertebrates by Jan A Pechenik, McGraw-Hill, 2014 Or
2. Invertebrates by Brusca and Brusca 2nd Ed, Sinauer Associates

References:

1. An introduction to Invertebrates by Janet Moore 2nd ed.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
3. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson
4. Chaudhury, S. (2017). Economic Zoology. New Central Book Agency
5. Invertebrate Zoology: Third Edition; Paul A Meglitsch, Frederick R Schram January 2020, OXFORD UNIVERSITY PRESS
6. (<https://www.nature.com/articles/nature16150>) for hemichordate phylogenetic relationships*
7. Students are encouraged to explore authentic websites (for e.g. Wikipedia, different university websites and OCWs) on internet for reading/audio-visual materials on a particular topic if they do not find enough in the text books or otherwise).

Course Outcome:

Students would appreciate the diversity of lower and higher invertebrates including arthropods, molluscs and echinoderms with a thorough understanding of the invertebrate animal architecture and functions during evolution. The major outcome is that the course would create awareness of the economic importance and significance of invertebrates. Students will be aware of the involvement of different invertebrate animals in human health and agriculture; diseases caused by invertebrates and the understanding of their modes of transmission by invertebrate animals.